

6.6

Graywater Collection and Use

Graywater reuse is an increasingly accepted practice to (1) provide irrigation water and some fertilizer to landscapes, (2) reduce wastewater loads to sewage systems, (3) improve the effectiveness of on-site wastewater disposal, and (4) reduce pressure on limited potable water resources in some communities, especially during drought crises. The State of California now allows graywater systems, and various municipalities and utility districts have passed specific graywater ordinances.

Opportunities

The primary motivation for installing graywater systems has been the ability to irrigate landscapes during dry seasons and times of more extreme drought. The installation of graywater systems requires modifications to existing plumbing systems and the addition of certain components. In new construction, it is relatively easy to incorporate a graywater system. Retrofitting such systems in existing buildings will be easiest when plumbing modifications are already planned. Buildings with basements or crawl spaces are far more amenable to plumbing system retrofits than those with slab-on-grade construction (where piping runs under the slab). Currently, the separation and use of graywater is not permitted in many parts of the country; be sure such a system is acceptable to local building officials before moving ahead with design and construction. Even if this is not permitted by code, it may make sense during new construction to install plumbing in such a way that a graywater system can be added later. Graywater collection and use can be especially important in buildings served by composting toilets.

Technical Information

TERMINOLOGY

Graywater is usually defined as water from showers, bathtubs, bathroom sinks, washing machines, and drinking fountains. It may also include condensation pan water from refrigeration equipment and air-conditioners, hot tub drainwater, pond and fountain drainwater, and cistern drainwater. Graywater contains a minimum amount of contamination and can be reused for certain landscape applications. Although this is still being debated by public health officials, no case of illness has ever been traced to graywater reuse. Graywater is distinguished from *blackwater*, which is usually defined as heavily soiled water from toilets and

urinals. Wastewater from kitchen sinks and dishwashers is occasionally included with “graywater,” but more commonly it is lumped with blackwater because it contains oil, grease, and food scraps, which can burden the treatment and disposal processes. Both graywater and blackwater contain pathogens—humans should avoid contact with either—but blackwater is considered a much higher risk medium for the transmission of waterborne diseases. Though they are not blackwater, the following water sources should not be included in graywater that is to be used for irrigation: garden and greenhouse sinks, water softener backflush, floor drains, and swimming pool water. In buildings served exclusively by composting toilets and thus producing no true blackwater, it may be necessary to include kitchen wastewater in the graywater by taking special precautions to eliminate organic matter.

Note that graywater is very different from reclaimed wastewater, which is covered in *Section 6.5*. Reclaimed, treated wastewater can be used for other applications, such as toilet flushing and above-ground irrigation, which are not permitted with untreated graywater.

GRAYWATER COLLECTION

Graywater collection involves separating graywater from all other sources of wastewater in a building—including wastewater from toilets, urinals, dishwashers,

CALIFORNIA REGULATIONS FOR GRAYWATER SETBACKS

Minimum Horizontal Distance From:	Surge Tank (feet) (meters)		Irrigation Field (feet) (meters)	
Buildings or structures	5	1.5	8	2.4
Property lines	5	1.5	5	1.5
Water supply wells	50	15.2	100	30.5
Streams and lakes	50	15.2	50	15.2
Seepage pits or cesspools	5	1.5	5	1.5
Disposal field and 100% expansion area	5	1.5	4	1.2
Septic tank	0	0.0	5	1.5
On-site domestic water service line	5	1.5	5	1.5
Pressure public water main	10	3.0	10	3.0
Water ditches	50	15.2	50	15.2
Note: Some variations and exceptions apply; see specific regulations.				

and kitchen sinks. Graywater waste lines should run to a central location in the basement or crawl space where a surge tank can collect and hold the water until it drains or is pumped into the below-ground irrigation lines. It is very important to provide an overflow from the graywater collection system that feeds directly into the sewer line in case filters get clogged or some other problem occurs. A controllable valve should also be included so that graywater can be shunted into the sewer line when the area(s) being irrigated become too wet or other reasons preclude the use of graywater (see cautionary note on protecting plants).

Graywater should not be stored for extended periods of time before use. Decomposition of the organic material in the water by microorganisms will quickly use up available oxygen, and anaerobic bacteria will take over, producing a foul smell. Some graywater systems are designed to dose irrigation pipes with a large, sudden flow of water instead of allowing the water to trickle out as soon as it enters the surge tank. For the dosing systems, holding the water for some amount of time will be necessary, but this should be limited to no more than a few hours, if possible.

If a filter is used in the graywater system, it should be one that is easy to clean or self-cleaning. Filter maintenance is one of the biggest problems with many graywater systems.

GRAYWATER DISPOSAL

For complete protection from pathogens, graywater should flow by gravity or be pumped to a below-ground disposed field (subsurface irrigation). Perforated plastic pipe—3 in. (76 mm) minimum diameter—is called for in California's graywater regulations, though with filtering, smaller-diameter drip irrigation tubing can also be used. The California standards require that untreated graywater be disposed of at least 9 in. (about 230 mm) below the surface of the ground.

Some graywater systems discharge into planter beds—sometimes even beds located inside buildings. Some ready-made systems are available by mail order, but these should be modified for specific soil and climate conditions.

As a general rule, graywater can be used for subsurface irrigation of lawns, flowers, trees, and shrubs but should not be used for vegetable gardens. Drip irrigation systems have not yet proven to be effective for graywater discharge because of clogging or maintenance costs.



Do not connect roof drains, downspouts, or patio runoff to a graywater system.



For optimal breakdown of organic matter in the graywater, the discharge should be in the biologically active portion of the ground (near the surface), so do not bury irrigation pipes too deeply.

MAINTENANCE

A maintenance program for graywater systems should include (1) inspecting the system for leaks and blockages, (2) cleaning or replacing any filters bimonthly or as recommended by the manufacturer or designer, (3) periodically flushing the entire system if called for by the manufacturer or designer, and (4) regularly inspecting the ground being irrigated to make sure that not too much water is being delivered (in which case, graywater should be shunted into the sewage line).



To protect plants being irrigated with graywater, it is important to control what cleaning and washing chemicals are used in the building. Avoid powdered detergents, which tend to be high in sodium and salts (liquid detergents are better); avoid boron, which can be toxic to some plants; and avoid chlorine bleach, caustic drain cleaners, petroleum distillates, and other chemicals with unknown effects on plants. In homes where cloth diapers are being rinsed or washed and in buildings where contagious illnesses are present, it is advisable to send graywater into the sewage line instead of collecting it for reuse.

References

Graywater Guide, California Department of Water Resources, Attn: Publications Office, P.O. Box 942836, Sacramento, CA 94236; (916) 653-1097; www.dwr.water.ca.gov. Introduction to graywater collection and use, as well as details on California's graywater regulations.

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Water Management: A Comprehensive Approach for Facility Managers, General Services Administration, 1995. For ordering information, call (202) 219-0062.